

An Empirical Study of the Impact of Digital Transformation on Employee Engagement: A Study of Guilin Deep Technology Co., Ltd.

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Abstract

Given that digital transformation is still in its nascent stage, enterprises are navigating significant risks and uncertainties. Insights from research data and practical experiences revealed that digital transformation transcends mere technological innovation; it encompasses the overhaul of business processes and strategic realignment. Focusing exclusively on technological reform while neglecting the psychological and behavioral dynamics of employees was inadequate for achieving the desired transformation outcomes. This study employed a quantitative research approach, collecting 402 valid responses through a survey questionnaire. The findings indicated that: 1) the variables of digital transformation had a markedly positive influence on employees' cognitive engagement; 2) these variables significantly enhanced employees' behavioral engagement; and 3) they further amplified employees' emotional engagement. Based on these insights, the paper proposed targeted recommendations to enhance the transformative impact through increased employee dedication during the digital transformation journey. These suggestions provided a fresh perspective and theoretical groundwork for enterprises embarking on digital transformation.

Keywords : Digital Transformation, Employee Engagement, Manufacturing, Empirical Analysis, Digitalize

Introduction

Digital transformation involves the comprehensive overhaul of business processes, capabilities, innovation models, and organizational activities, driven by digital technologies to enhance operational efficiency (Demirkan, Spohrer, & Welser, 2016). Although there is no unified definition, scholars generally agree that digital transformation is inseparable from informatization, which refers to the digitalization of enterprise elements based on network database technology and communication, aggregated into a database for resource sharing (Li & Yu, 2022). Definitions of digital transformation typically emphasize changing value creation methods, innovating business models, and using data to guide enterprise construction and value chains (Hanna, 2016).

In recent years, Chinese enterprises have shown strong momentum in digital transformation, though significant differences in digitalization levels persist, leading to varied transformation outcomes (Wang, 2020). Scholars globally are exploring factors influencing digital transformation based on internal development and external environmental changes. For instance, Vial (2019) asserts that digital transformation is an ongoing process, not a single step, and firms must proactively adopt it to mitigate market risks and enhance value creation. Schallmo (2017) and Verhoef (2021) highlight the importance of using digital technologies to collect, organize, and analyze information, which supports business development decisions and the creation of new digital business models. Reddy (2017) suggests that combining Internet and computer technology can create efficient work systems for businesses, further emphasizing the transformative potential of digitalization.

Objectives

The main objectives of this study are to:

1. Identify the factors of digital transformation and employee engagement.
2. Investigate the impact of various dimensions of digital transformation on employee engagement.

Literature Review

Digital Transformation

Digital transformation involves reconfiguring business processes and organizational activities using digital technologies for efficient operation and development (Demirkan, Spohrer, & Welser, 2016). It is closely linked to informatization, which digitizes enterprise elements for resource sharing (Li & Yu, 2022). The goal is to change value creation methods, innovate business models, and use data to guide enterprise operations (Hanna, 2016). Vial (2019) emphasizes that digital transformation is ongoing, helping firms mitigate risks and enhance value. Schallmo (2017) and Verhoef (2021) highlight the role of digital technologies in improving operations, while Reddy (2017) focuses on combining Internet and computer technology for efficiency. Factors influencing digital transformation include technological advancements and the need to master production technologies to establish responsive systems (Zhao, 2017). Internally, digital technology enhances transparency, reduces information asymmetry, and improves customer information exploration (Yi, 2021).

Employee Engagement

Employee engagement encompasses physical, psychological, and emotional involvement in work (Kahn, 1990). It reflects employees' unity with their work roles, indicating energy investment and achievement (Jaramillo, 2018). Highly engaged employees contribute beyond work hours (Zhou, 2022) and enhance organizational performance through emotional and idealistic commitment (Huang & Qian, 2014). Factors influencing engagement include attachment to the work environment, corporate culture, and colleague relationships, which enhance positive emotions and performance (Madan, 2016). Engaged employees show higher responsibility, commitment, motivation, and enthusiasm, driving innovation (Zhou & Sun, 2017). Yuan (2021) and Liu (2017) found that organizational identity boosts motivation and satisfaction, while Saks (2006) suggests that engagement results from organizational support. Engagement is typically divided into cognitive, emotional, and behavioral dimensions (Rich, Lepine, & Crawford, 2010; Thilepan, 2022).

Relationship Between Digital Transformation and Employee Engagement

Research indicates that digital transformation positively impacts employee engagement by enhancing initiative and responsibility (Kane, 2015; Lauby, 2018). Thilepan and Raveendran (2022) found that digital transformation positively affects engagement across various dimensions. Goswami (2019) observed that aspects of digital transformation, such as customer experience, operational efficiency, and business models, significantly impact engagement in the IT industry. Digital transformation can predict employee engagement, emphasizing the need for further exploration. Theories such as digital economy theory and two-factor theory provide a framework for understanding this relationship. Digital economy theory focuses on digital technologies driving economic activities and innovation (Heeks, 2016). Two-factor theory posits that engagement and satisfaction are influenced by motivational factors related to work content and environment (Zhao, 2023). These theories suggest that digital transformation enhances engagement by improving processes, providing learning opportunities, and creating a supportive work environment.

Theoretical framework

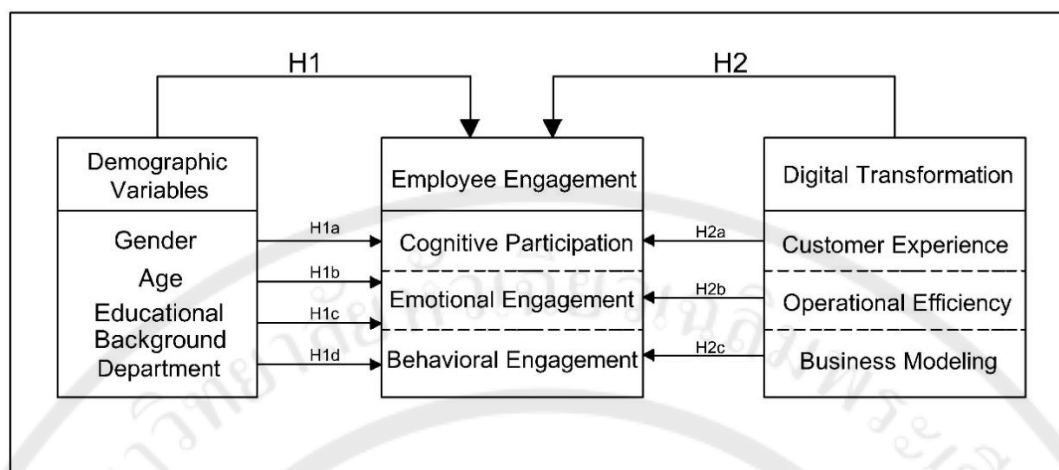


Figure 1 Theoretical framework

Research hypotheses

H1: There is a significant effect of respondents' personal trait differences on employee engagement.

H1a: There is a significant effect of the gender of respondents on employee engagement.

H1b: There is a significant effect of the age of the respondents on employee engagement.

H1c: There is a significant effect of the educational qualification of the respondents on employee engagement.

H1d: There is a significant effect of respondents' departments on employee engagement.

H2: Digital transformation has a positive and positive effect on employee engagement.

H2a: Digital transformation variables have a positive positive effect on employee cognitive engagement

H2b: Digital transformation variables have a positive positive effect on employee emotional engagement.

H2c: Digital transformation variables have a positive effect on employee behavioral engagement.

Materials and Methods

This study employed a quantitative methodology to examine the impact of digital transformation on employee engagement at Guilin Deep Technology Co., Ltd. The target population comprised 6,500 employees, with a sample size of 402 determined using Yamane's formula, ensuring a 95% confidence level and a 5% margin of error. Data were collected through a structured questionnaire distributed via the "Wen Juanxing" platform. The questionnaire included three sections: demographic information, the Digital Transformation Measurement Scale (DTMS) based on Goswami and Upadhyay (2019) and Thileepan and Raveendran (2022), and the Employee Engagement Scale (EES) adapted from Rich, Lepine, and Crawford (2010). The DTMS assessed customer experience, operational efficiency, and business models, while the EES measured cognitive, behavioral, and emotional engagement. Responses were rated on a 5-point Likert scale.

The reliability and validity of the scales were confirmed with high Cronbach's alpha values (overall 0.978, each dimension > 0.8). The KMO measure (0.988) and Bartlett's test ($\chi^2 = 9185.549$, $p < 0.001$) indicated suitability for factor analysis. Data were analyzed using advanced statistical software for descriptive statistics, correlation analysis, and regression

analysis. The high reliability and validity ensure robust insights into the effects of digital transformation on employee engagement at Guilin Deep Technology Co., Ltd.

Results

Descriptive Statistical Analysis

Table 1 Descriptive statistical analysis of variables related to personal traits

Attitude	classification indicators	N	Frequency	Percent
Gender	Male	402	216	53.7
	Female	402	186	46.3
age	Under 20 years old	402	1	0.2
	21-30 years old	402	124	30.8
	31-40 years old	402	146	36.3
	Over 41 years old	402	131	32.6
	education attainment	College degree or below	402	94
education attainment	undergraduate course	402	279	69.4
	master	402	25	6.2
	PhD	402	4	1.0
sectoral	Warehouse management	402	75	18.7
	Logistics	402	72	17.9
	Human resources or finance	402	92	22.9
	Quality inspection or quality control	402	163	40.5

The descriptive statistical analysis of variables related to personal traits revealed that the sample consisted of 216 males (53.7%) and 186 females (46.3%). The age distribution showed that the largest group was aged 31-40 years (36.3%), followed by those aged 41 and above (32.6%) and 21-30 years (30.8%), with only one respondent under 20 years (0.2%). In terms of educational background, the majority of respondents held a bachelor's degree (69.4%), followed by those with a college degree or below (23.4%), and a smaller number with a master's degree (6.2%) and a doctoral degree (1.0%). Position-wise, most respondents worked in quality inspection or quality control (40.5%), followed by human resources or finance (22.9%), warehouse management (18.7%), and logistics (17.9%). Overall, the sample showed a higher number of male respondents, predominantly working in quality-related and administrative positions, with a majority holding a bachelor's degree or lower.

Table 2 Means and standard deviation analysis for each study variable

	variant	N	Mean	S.D.
Digital transformation	Customer	402	3.713	0.761
	Experience			
	Operational Efficiency	402	3.713	0.670
Employee engagement	Business Models	402	3.690	0.701
	Cognitive	402	3.697	0.703
	Engagement			
	Behavioral	402	3.687	0.700
	Engagement			
	Emotional	402	3.719	0.705
	Engagement			

The descriptive statistical analysis in Table 2 showed that respondents' perception levels of the dimensions of "digital transformation" had mean values of 3.713, 3.713, and 3.690, with standard deviations of 0.761, 0.670, and 0.701, respectively. These mean values, all above 3.5, indicated that employees at Guilin Deep Technology Co., Ltd. had a moderate to high perception of digital transformation. Similarly, for "Employee Engagement," the perception

levels had mean values of 3.697, 3.687, and 3.719, with standard deviations of 0.703, 0.700, and 0.705, respectively. These findings suggested that employees at Guilin Deep Technology Co., Ltd. also had a moderate to high perception of employee engagement.

Correlation analysis

Table 3 Correlation analysis between research variables

		Customer Experience	Operational Efficiency	Business Models
Cognitive Engagement	Pearson	0.900**	0.868**	0.868**
	Sig.	0.000	0.000	0.000
Behavioral Engagement	Pearson	0.906**	0.877**	0.866**
	Sig.	0.000	0.000	0.000
Emotional Engagement	Pearson	0.896**	0.877**	0.863**
	Sig.	0.000	0.000	0.000

** . At the 0.01 level (two-tailed), the correlation is significant

According to the correlation analysis between the variables in Table 3, there was a significant positive correlation between the dimensions of digital transformation and employee engagement. The Pearson correlation coefficients in the correlation analysis were all greater than 0.8, and the P-values were all 0.000, indicating a "strong correlation" between the variables. The details were as follows:

1) The Pearson correlation coefficients between customer experience and employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension were 0.900**, 0.906**, and 0.896**, respectively, with a significance level of $0.000 < 0.01$. This showed that customer experience had a significant positive correlation with employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension.

2) The Pearson correlation coefficients between operational efficiency and employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension were 0.868**, 0.877**, and 0.877**, respectively, with a significance level of $0.000 < 0.01$. This showed that operational efficiency had a significant positive correlation with employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension.

3) The Pearson correlation coefficients between the business model and employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension were 0.868**, 0.866**, and 0.863**, respectively, with a significance level of $0.000 < 0.01$. This showed that the business model had a significant positive correlation with employees' cognitive engagement, behavioral engagement, and emotional engagement in the digital transformation dimension.

Regression analysis

Regression analysis was mainly based on "Pearson correlation analysis" to further verify the existence of causal relationships between variables and the degree of influence between them. According to Table 4.15, the correlation analysis showed that the variables had different degrees of significant positive correlation, but this test could not further determine the causal relationship between the variables. Therefore, to further judge the relationship existing between the variables and verify the research hypotheses proposed in this paper, advanced statistical software was used to perform linear regression analysis on the conceptual framework and related research hypotheses constructed in Chapter 2. In this regression analysis, the dimensions of digital transformation were taken as independent variables, and the dimensions of employee engagement were taken as dependent variables to carry out regression analysis sequentially, as shown below:

Table 4 Regression Analysis of Digital Transformation Dimensions on Employee Cognitive Engagement

		Unstandardized coefficient	standardization factor			R ²	Adjustment of R ²
model		B	Beta	t	Sig.		
1	(Constant)	13.828		15.840	0.000	0.016	0.006
	Gender	-0.097	-0.017	-0.342	0.732		
	Age	0.050	0.014	0.286	0.775		
	Education level	0.052	0.010	0.204	0.839		
	department	0.301	0.123	2.450	0.015*		
2	(Constant)	0.768		1.619	0.106	0.840	0.837
	Gender	-0.170	-0.030	-1.469	0.143		
	Age	0.121	0.034	1.708	0.088		
	Education level	0.119	0.024	1.160	0.247		
	department	0.024	0.010	0.470	0.639		
	Customer Experience	0.462	0.500	8.963	0.000**		
	Operational Efficiency	0.205	0.196	3.867	0.000**		
	Business Model	0.251	0.250	5.280	0.000**		

* level of significance 0.05

** level of significance 0.01

In the linear regression analysis in Table 4 of "Digital Transformation Dimensions and Employee Cognitive Engagement," it was found that the R-square of the demographic variable of model 1 for the respondents was 0.016 at the 0.05 level of significance. This indicated that the dimensions of "Employee Gender, Age, Education, and Department" could explain 1.6% of the change in the dimension of "Employee Cognitive Engagement" in the context of digital transformation. The adjusted R-square value was 0.006, showing that demographic variables jointly explained 0.6% of the change in employee cognitive engagement after excluding the effect of the number of independent variables in the model.

Based on the demographic variables and adding the dimensions of digital transformation, the R² of the regression analysis was 0.840, and the adjusted R² value was 0.837. This indicated that the "Customer Experience, Operational Efficiency, and Business Model" dimensions of digital transformation together explained 83.7% of the change in the "Employee Cognitive Engagement" dimension. In the regression analysis, the regression coefficients of "Customer Experience, Operational Efficiency, and Business Model" were 0.500 (t=8.963, P=0.000<0.05), 0.196 (t=3.867, P=0.000<0.05), and 0.250 (t=5.280, P=0.000<0.05), respectively. Thus, it was illustrated that the dimensions of digital transformation had a significant positive impact on employees' cognitive engagement, supporting the research hypothesis H2a.

The equation of regression was written as: Digital transformation on cognitive engagement = 0.768 + 0.121(Age) + 0.462(Customer Experience) + 0.205(Operational Efficiency) + 0.251(Business Model).

Table 5 Regression Analysis of Digital Transformation Dimensions on Employee Behavioral Engagement

Model		Unstandardized	Standardization	t	Sig.	R ²	Adjustment of R ²
		Coefficient	Factor				
1	(Constant)	14.496		16.669	0.000	0.013	0.003
	Gender	-0.162	-0.029	-0.570	0.569		
	Age	0.009	0.003	0.053	0.958		
	Education level	-0.154	-0.031	-0.610	0.542		
	department	0.262	0.107	2.137	0.033*		
2	(Constant)	1.397		3.054	0.002**	0.849	0.847
	Gender	-0.232	-0.041	-2.075	0.039*		
	Age	0.081	0.023	1.180	0.239		
	Education level	-0.088	-0.018	-0.889	0.375		
	department	-0.015	-0.006	-0.313	0.755		
	Customer	0.473	0.515	9.521	0.000**		
	Experience						
	Operational	0.246	0.236	4.801	0.000**		
	Efficiency						
	Business Model	0.201	0.201	4.380	0.000**		

* level of significance 0.05

** level of significance 0.01

In the linear regression analysis in Table 5 of "Digital Transformation Dimensions and Employee Behavioral Engagement," it was found that the R-square of the demographic variable of the respondents was 0.013* at the 0.05 level of significance, indicating that the dimensions of "Employee's Gender, Age, Education, and Department" of digital transformation explained 1.3% of the variation in the "Employee Behavioral Engagement" dimension. The adjusted R-square value was 0.003**, showing that demographic variables jointly explained 0.3% of the variation in employee behavioral engagement after excluding the effect of the number of independent variables in the model.

Based on the demographic variables, the R² of the regression analysis of the dimensions of digital transformation on employee behavioral engagement was 0.849, and the value of the adjusted R² was 0.847. This indicated that the dimensions of digital transformation "Customer Experience, Operational Efficiency, and Business Model" together explained 84.7% of the change in the "Employee Behavioral Engagement" dimension. In the regression analysis, the regression coefficients of "Customer Experience, Operational Efficiency, and Business Model" were 0.515 (t=9.521, P=0.000<0.01), 0.236 (t=4.801, P=0.000<0.01), and 0.201 (t=4.380, P=0.000<0.01), respectively. Thus, it was illustrated that the dimensions of digital transformation had a significant positive impact on the behavioral engagement of employees, supporting the research hypothesis H2b.

The equation of regression was written as: Digital transformation dimensions and employee behavioral engagement = 1.397 - 0.232 (Gender) + 0.473 (Customer Experience) + 0.246 (Operational Efficiency) + 0.201 (Business Model).

Table 6 Regression Analysis of Digital Transformation Dimensions on Employee Emotional Engagement

model	Unstandardizedstandardization		t	Sig.	R ²	Adjustment of R ²
	coefficient	factor				
	B	Beta				
1 (Constant)	14.348		16.370	0.000	0.013	0.003
Gender	-0.039	-0.007	-0.136	0.892		
Age	-0.037	-0.011	-0.214	0.831		
Education level	-0.047	-0.009	-0.183	0.855		
department	0.275	0.112	2.232	0.026*		
2 (Constant)	1.093		2.268	0.024*	0.835	0.832
Gender	-0.096	-0.017	-0.817	0.415		
Age	0.030	0.009	0.424	0.672		
Education level	0.015	0.003	0.147	0.883		
department	0.001	0.000	0.021	0.983		
Customer Experience	0.404	0.436	7.711	0.000**		
Operational Efficiency	0.298	0.283	5.523	0.000**		
Business Model	0.229	0.227	4.726	0.000**		

* level of significance 0.05

** level of significance 0.01

In the linear regression analysis in Table 6 for "Digital Transformation Dimensions and Employee Emotional Engagement," it was found that the R-square of the demographic variable of the respondents was 0.013* at the 0.05 level of significance, indicating that the dimensions of "Employee Gender, Age, Education, and Department" could explain 1.3% of the variation in the dimension of "Employee Emotional Engagement" in the context of digital transformation. The adjusted R-square value was 0.003, showing that demographic variables together explained 0.3% of the variation in employee emotional engagement after excluding the effect of the number of independent variables in the model.

The R² of the regression analysis of the dimensions of digital transformation on employee emotional engagement was 0.835, and the adjusted R² was 0.832. This indicated that the dimensions of "Customer Experience, Operational Efficiency, and Business Model" in digital transformation together explained 83.2% of the variation in the "Employee Emotional Engagement" dimension. In the regression analysis, the regression coefficients of "Customer Experience, Operational Efficiency, and Business Model" were 0.436 (t=7.711, P=0.000<0.01), 0.283 (t=5.523, P=0.000<0.01), and 0.227 (t=4.726, P=0.000<0.01), respectively. Thus, it was illustrated that the dimensions of digital transformation had a significant positive impact on employees' emotional engagement, supporting the research hypothesis H2c.

The regression equation was: Digital transformation dimensions and employee emotional engagement = 1.093 + 0.404 (Customer Experience) + 0.298 (Operational Efficiency) + 0.229 (Business Model).

According to the results of each of the above regression analysis tests, it was seen that: 1) the dimensional variables of digital transformation had a positive impact on the cognitive

engagement of employees; 2) the dimensional variables of digital transformation had a significant positive impact on the behavioral engagement of employees; 3) the dimensional variables of digital transformation had a significant positive impact on the emotional engagement of employees. The research hypotheses H2, H2a, H2b, and H2c were valid.

In summary, the analysis revealed that digital transformation positively influenced all dimensions of employee engagement. Specifically:

Cognitive Engagement: Employees perceived digital transformation as enhancing transparency and strategic decision-making.

Behavioral Engagement: Digital transformation facilitated teamwork and daily decision-making processes.

Emotional Engagement: Training opportunities and teamwork were highly motivating for employees in a digitally transformed environment.

Discussion

The findings from this study demonstrate that digital transformation significantly impacts employee engagement at Guilin Deep Technology Co., Ltd. Digital transformation positively influences cognitive, behavioral, and emotional engagement, emphasizing the need for enterprises to address both technological and human factors. Cognitive engagement is enhanced by introducing new technologies and improving work processes, providing employees with learning opportunities and challenges. Employees at Guilin Deep Technology can access the latest technical knowledge and industry information through digital training programs and online learning platforms, which helps improve their skills and deepen their understanding of corporate strategies. Customizing learning paths and providing personalized development plans based on employees' career goals can further enhance cognitive engagement.

Behavioral engagement is inspired by optimizing workflows and improving efficiency. Agile working methods and digital tools that facilitate cross-departmental collaboration enable employees to be more proactive in projects, increasing motivation and engagement. Giving employees more autonomy and decision-making power enhances their sense of responsibility and engagement, contributing to the successful completion of tasks. Emotional engagement is strengthened by increasing transparency and facilitating team interaction. The use of internal social networks and instant messaging tools allows employees to share information, exchange ideas, and celebrate achievements, building trust and a sense of belonging. Team-building activities and social events further promote emotional engagement and loyalty among employees.

The study indicates that customer experience, operational efficiency, and business models, as dimensions of digital transformation, have significant positive relationships with cognitive, behavioral, and emotional engagement. For instance, regression analysis shows that these dimensions positively influence cognitive engagement, with regression coefficients of 0.500, 0.196, and 0.250, respectively. This suggests that digital transformation has a profound impact on employee engagement, and enterprises should adopt a holistic approach, integrating technological advancements with strategies to enhance cognitive, behavioral, and emotional engagement. This dual focus will help maximize employee performance and organizational success in the digital age. Future research could explore additional factors influencing employee engagement in different industrial contexts to further validate these findings.

Conclusion

This study concludes that digital transformation positively affects employee engagement at Guilin Deep Technology Co., Ltd. By examining the impact on cognitive, behavioral, and emotional engagement, the findings highlight the necessity for enterprises to adopt a holistic approach that integrates technological advancements with strategies to enhance employee engagement.

Key Findings

Digital transformation, encompassing customer experience, operational efficiency, and business models, has shown a significant positive impact on employee engagement. Cognitive engagement is enhanced by providing employees with learning opportunities and challenges through digital training programs and online platforms. Behavioral engagement improves as digital tools facilitate cross-departmental collaboration and empower employees with more autonomy and decision-making power. Emotional engagement is strengthened by increasing transparency and team interaction through internal social networks and instant messaging tools.

The regression analysis demonstrates the positive relationship between digital transformation dimensions and employee engagement. Customer experience, operational efficiency, and business models significantly influence cognitive engagement, with regression coefficients of 0.500, 0.196, and 0.250, respectively. Similarly, these dimensions positively impact behavioral and emotional engagement, supporting the research hypotheses H2, H2a, H2b, and H2c.

Implications for Practice

The study suggests that enterprises should focus on both technological and human factors to maximize the benefits of digital transformation. By adopting a holistic approach, companies can enhance employee cognitive, behavioral, and emotional engagement, leading to improved performance and organizational success. Future research should explore additional factors influencing employee engagement in different industrial contexts to further validate these findings and provide a broader understanding of the impact of digital transformation on employee engagement.

In conclusion, digital transformation profoundly impacts employee engagement, and a dual focus on technological advancements and employee engagement strategies will help enterprises navigate the complexities of digital transformation effectively.

Acknowledgements

As I approach the end of my college years, I reflect on this fulfilling and brief period, and I am grateful to many people who have provided help and support at different stages. I would like to express my most sincere thanks to them.

Firstly, I would like to extend my deepest respect to my supervisor, Dr. Chatcharawan Meesubthong. I am grateful for her tireless efforts in revising my thesis, her kind encouragements, and her patience in answering my queries. Her support has been invaluable in helping me complete my thesis. Additionally, I would like to thank Dr. Ianthom for her valuable advice on revising my thesis, particularly regarding formatting. I am also grateful to Assoc. Prof. Dr. Orasa Tetiwat, the chairman of the dissertation defense examiners, for supporting me and suggesting revisions to my dissertation.

Secondly, I want to thank my classmates. We supported each other throughout the thesis writing process, and their camaraderie was a great source of motivation.

Finally, I would like to thank my family. Your unwavering support and encouragement have been the source of my motivation and progress.

In conclusion, I express my deep gratitude to all my relatives, teachers, and friends who have cared about me and supported me along the way. Thank you once again for your kindness and support.

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